The Effect of Body Mass Index, Negative Affect, and Disordered Eating on Health-Related Quality of Life in Preadolescent Youth: A Moderated Mediation Analysis

By

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Abstract

Objective: To examine the indirect effect of BMI z-score on health-related quality of life (HRQOL) through disordered eating attitudes and behaviors in a community sample of preadolescent children, as well as the degree to which negative affect moderated the association between BMI z-score and disordered eating attitudes and behaviors. Methods: Participants included 165 predominately Caucasian children (50% female) between 8 and 12 years of age (M= 9.41, SD= 1.01). HRQOL, disordered eating attitudes and behaviors, and negative affect were assessed using self-report measures, and height and weight were collected by research staff in order to calculate BMI z-score. The conditional indirect effects of BMI on HRQOL through disordered eating attitudes and behaviors at different values of negative affect were analyzed while controlling for child age and gender. Results: Consistent with previous research in treatment-seeking and adolescent samples, the indirect effect of BMI z-score on HRQOL through disordered eating attitudes and behaviors was significant in the community sample of preadolescents. Findings failed to provide support for the hypothesis that negative affect moderated the relationship between BMI z-score and disordered eating attitudes and behaviors. Conclusion: Intervening on disordered eating attitudes and behaviors in preadolescents with higher weight status is critical to prevent the risk trajectory for future clinical eating disorders and poor HRQOL.

Table of Contents

Page

Introduction....1
Method....7
Participants....7
Procedure....8
Measures....8
Demographics....8
Weight Status....8
Health-Related Quality of Life....9
Disordered Eating Attitudes and Behaviors....9
Negative Affect....11
Data Analytic Plan....11
Results....12
Preliminary Analyses....12
Mediation Analyses....14
Moderated Mediation Analyses....15
Discussion....17
References....22

The Effect of Body Mass Index, Negative Affect, and Disordered Eating on Health-Related Quality of Life in Preadolescent Youth: A Moderated Mediation Analysis

Current estimates suggest that the lifetime prevalence rate for eating disorders, including anorexia nervosa, bulimia nervosa, and binge eating disorder, among youth aged 13-18 is 2.7% (Merikangas et al., 2010b). Among a younger population of children and adolescents aged 8-15, the 12-month prevalence rate for eating disorders is approximately 0.1% (Merikangas et al., 2010a). Although the prevalence of full-syndrome eating disorders is relatively low in youth, symptoms of disordered eating attitudes and behaviors, such as binge eating, restricting intake, vomiting, and weight/shape concerns, are especially common among children and adolescents, with estimates approaching 60% in adolescent samples (e.g., Ackard, Fulkerson, & Neumark-Sztainer, 2007; Croll, Neumark-Sztainer, Story, & Ireland, 2002; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011).

Disordered eating attitudes and behaviors have traditionally been understood to develop in adolescence, but recent studies have found that they may originate even earlier in childhood. For instance, in a study of disordered eating behaviors in 5th grade children, 12.1% reported binging, 9.8% reported restricting intake, and 4.8% reported purging in the past two weeks; these behaviors were similar for both boys and girls and predicted middle school engagement in disordered eating (Combs, Pearson, Zapolski, & Smith, 2013). Furthermore, Evans, Tovée, Boothroyd, and Drewett (2013) asserted that the underlying processes of disordered eating, such as thin-ideal internalization and body dissatisfaction, were present well before adolescence, possibly in children as young as 7 years old. These studies indicate that disordered eating attitudes and behaviors are extant in both preadolescent boys and girls and that the risk trajectory continues into adolescence (Combs et al., 2013).

The high prevalence of disordered eating attitudes and behaviors in childhood is particularly alarming because these symptoms are risk factors for subsequent negative physical consequences including malnutrition, weight cycling, obesity, and full-syndrome eating disorders (French & Jeffery, 1994; Johnson, Cohen, Kasen, & Brook, 2002; Neumark-Sztainer et al., 2006). In addition to these negative physical consequences, children who exhibit disordered eating attitudes and behaviors are also prone to negative psychosocial consequences including depression, increased substance use, decreased self-esteem, and suicidal ideation (Ackard, Fulkerson, & Neumark-Sztainer, 2011; Brausch & Gutierrez, 2009; Wertheim, Paxton, & Blaney, 2009). More globally, research has shown that children and adolescents exhibiting disordered eating attitudes and behaviors report poorer health-related quality of life (HRQOL; e.g., Doyle, le Grange, Goldschmidt, & Wilfley, 2007; Gowey, Lim, Clifford, & Janicke, 2014; Herpertz-Dahlmann, Wille, Hölling, Vloet, & Ravens-Sieberer, 2008), a multidimensional concept that includes one's subjective experience of both positive and negative aspects of his or her physical, psychological, and social functioning (Kuyken, 1995). For example, Herpetz-Dahlmann et al. (2008) found that adolescents who reported disordered eating behaviors also reported poorer HRQOL, and Gowey et al. (2014) found that there was an inverse relationship between disordered eating attitudes and behaviors and HRQOL in a sample of preadolescents.

Because of the significant associations between disordered eating attitudes and behaviors and HRQOL, attention has been given to examining the predictors of disordered eating in clinical and community samples. One common predictor of disordered eating attitudes and behaviors among preadolescents is body mass index (BMI). Higher BMI is thought to be associated with more pressure from family, peers, and the media to be thinner, which can lead to increased risk for disordered eating attitudes and behaviors to achieve the thin-ideal (Paxton,

Eisenberg, & Neumark-Sztainer, 2006; Stice, 2002). Research with preadolescent populations indicates that boys and girls with higher BMI exhibit more disordered eating attitudes and behaviors such as wanting to be thinner and engaging in dieting and other weight-loss strategies (e.g., Candy & Fee, 1998; Evans et al., 2013; Rolland, Farnill, & Griffiths, 1997; Ricciardelli, McCabe, Lillis, & Thomas, 2006; Tanofsky-Kraff et al., 2004). For example, Ricciardelli and colleagues (2006) found that BMI was a significant predictor of preadolescent boys' body dissatisfaction and body change strategies, and Evans et al. (2013) corroborated that BMI predicted body dissatisfaction in preadolescent girls. Additionally, Vander Wal (2012) described that obese boys and girls reported higher levels of disordered eating behaviors such as vomiting, using laxatives to lose weight, and fasting than their non-obese counterparts.

In addition to associations with disordered eating attitudes and behaviors, BMI has also been associated with poorer HRQOL. For example, Tsiros et al. (2009) found that higher BMI has a moderate to strong negative association with HRQOL in youth and that physical and social functioning is especially impaired. Further, in a recent literature review of 34 studies examining quality of life in overweight and obese youth, all but three studies indicated a significant association between quality of life (QOL) and BMI (Buttitta, Iliescu, Rousseau, & Guerrien, 2014). Consistent with Buttitta et al.'s review, Ul-Haq, Mackay, Fenwick, and Pell (2013) found that HRQOL decreased as BMI increased from normal weight through obesity, with impairments in both physical and psychosocial functioning. Specifically, Ul-Haq et al. (2013) found that the overall HRQOL score for obese youth was 10.6 points lower than normal-weight youth (95% CI, 14.0-7.2; $p < .001$).

Previous research has shown that that both BMI (e.g., Buttitta et al., 2014; Tsiros et al., 2009; Ul-Haq et al., 2013) and disordered eating attitudes and behaviors (e.g., Doyle et al., 2007;

Gowey et al., 2014; Herpertz-Dahlmann et al., 2008) independently predict poorer HRQOL. Additionally, BMI has been shown to predict disordered eating attitudes and behaviors (e.g., Candy & Fee, 1998; Evans et al., 2013; Rolland, Farnill, & Griffiths, 1997; Ricciardelli, McCabe, Lillis, & Thomas, 2006; Tanofsky-Kraff et al., 2004). Therefore, it follows that children with higher weight status may engage in disordered eating attitudes and behaviors in order to achieve the thin ideal, and these disordered eating attitudes and behaviors may predict poorer psychosocial functioning. In other words, disordered eating may be one mechanism that underlies the relationship between BMI and HRQOL (see Figure 1).

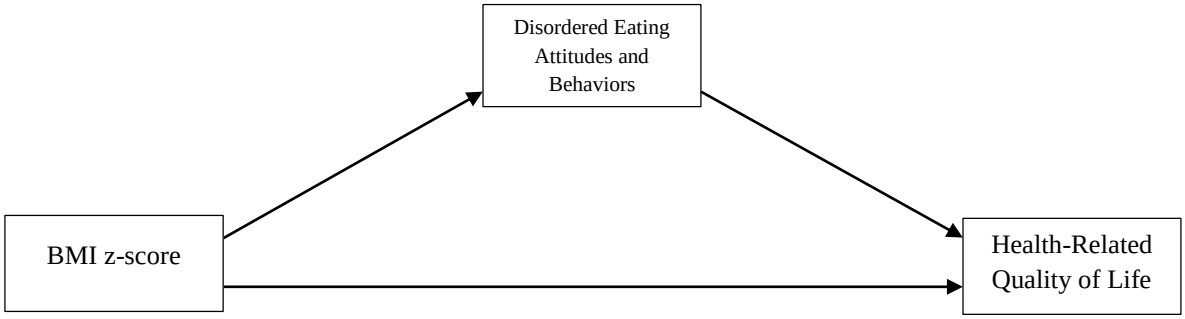

Figure 1. Mediation model: Influence of Body Mass Index on health-related quality of life through disordered eating attitudes and behaviors.

Indeed, there is some recent support for a model in which BMI is indirectly associated with HRQOL through disordered eating attitudes and behaviors in youth. For example, in a community sample of adolescents, youth who were overweight or obese reported more disordered eating and lower global HRQOL than non-overweight peers (Herpertz-Dahlmann et al., 2008). Likewise, in a sample of obese treatment-seeking adolescents, higher reports of weight and shape concerns were associated with lower HRQOL (Doyle et al., 2007). Further,

one study was identified that examined all three main variables of interest (BMI, disordered eating, and HRQOL) in a preadolescent sample: Gowey et al. (2014) examined predictors of HRQOL in a treatment-seeking sample of preadolescents (ages 8-12) and found that both BMI and disordered eating attitudes and behaviors were predictors of HRQOL in rural, obese children. However, this study did not allow a specific test of the direct and indirect associations between the variables.

Given the recent data indicating an increased prevalence of disordered eating attitudes and behaviors in preadolescents (e.g., Combs et al., 2013), more research examining the relationships between BMI, disordered eating, and HRQOL should be extended to a younger population. To expand the work by Gowey et al. (2014), the present study examined the direct and indirect associations among BMI, disordered eating attitudes and behaviors, and HRQOL in a community sample of preadolescents. Whereas clinical samples of obese children usually include children with BMIs at or above the 99th percentile and often include children who are exhibiting extreme disordered eating symptoms and significant impairments in quality of life, a community sample allowed for the examination of the variables across a range of BMI values and severities of disordered eating and HRQOL. The examination of these variables in a community sample allowed for more generalizability to the general population of children, perhaps before syndrome-level symptoms begin.

Based on the existing literature, disordered eating may be one mechanism that underlies the relationship between BMI and HRQOL (see Doyle et al., 2007; Gowey et al., 2014; Herpertz-Dahlmann et al., 2008). However, not all children with high BMI report disordered eating attitudes and behaviors, so it is important to examine possible moderators of this relationship as well. Negative affect, comprising moods such as fear, guilt, anger, and sadness,

is one psychological factor that has been shown to be associated with disordered eating (Holt & Ricciardelli, 2002; Sim & Zeman, 2006; Stice, 2002), and which may moderate the association between BMI and disordered eating attitudes and behaviors. In a recent meta-analysis, Stice (2002) found that among children and adults, negative affect was a risk factor for disordered eating and predicted body dissatisfaction and binge eating. More recently, in their exploration of the biopsychosocial model of disordered eating in adolescent girls, Rodgers, Paxton, and McLean (2014) examined negative affect as a psychological predictor of disordered eating in early adolescent girls. The authors found that BMI and negative affect were correlated, that BMI was a predictor of body image concerns, and that negative affect was a predictor of bulimic symptoms (Rodgers et al., 2014).

Because Rodgers and colleagues (2014) found that BMI was correlated with negative affect, but did not predict it, and because both BMI and negative affect were predictive of disordered eating attitudes and behaviors, there may be an interaction between BMI and negative affect that predicts disordered eating. In an exploration of this process in a sample of adolescents, Vander Wal (2012) found that weight status and negative affect were associated with unhealthy weight control behaviors, and that there was an interaction between weight status and negative affect for girls, such that girls with higher BMI and negative affect were at greater risk for unhealthy weight control behaviors. This finding suggests that negative affect may be a moderator between BMI and disordered eating attitudes and behaviors (see Figure 2).

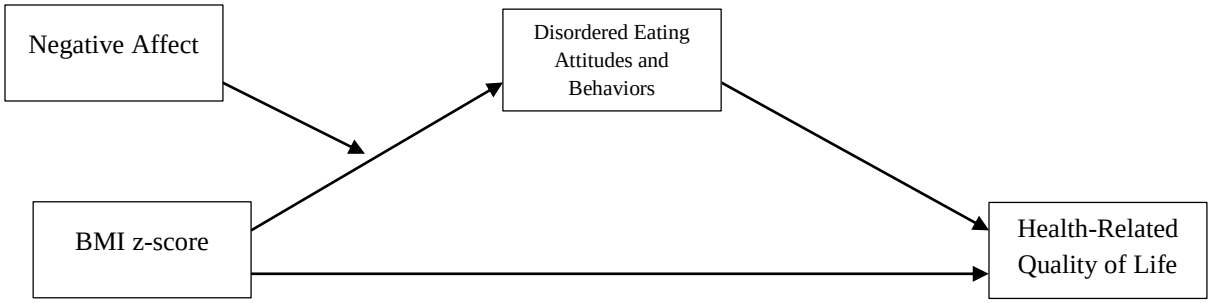

Figure 2. Moderated mediation model: Influence of Body Mass Index on health-related quality of life through disordered eating attitudes and behaviors with negative affect as a moderator.

The primary goal of the current study was to examine the indirect effect of BMI on HRQOL through disordered eating attitudes and behaviors in a community sample of preadolescent children. In addition, the study examined the degree to which negative affect moderated the association between BMI and disordered eating attitudes and behaviors. First, and consistent with existing literature, it was hypothesized that BMI would be positively correlated with disordered eating attitudes and behaviors. Additionally, it was expected that disordered eating attitudes and behaviors would be negatively associated with HRQOL. Lastly, it was hypothesized that the indirect effect of BMI on HRQOL through disordered eating attitudes and behaviors would be significant only for those with high levels of negative affect (see Figure 2). These relationships were examined while controlling for age and gender.

Method

Participants

Participants included 165 students between the ages of 8 and 12 who were enrolled in third through fifth grades at two Midwest elementary schools. Children were deemed eligible if: (a) they were enrolled in third, fourth, or fifth grades in designated elementary schools, (b) they

read and spoke English, (c) they were above the 5th percentile for BMI[1], and (d) their parents or guardians provided written consent for participation.

Procedure

Participants were recruited from two public elementary schools in a Midwest United States community by distributing information letters and consent forms to parents of all third, fourth, and fifth grade students. Recruitment occurred in schools targeted for diversity across race, ethnicity, and socioeconomic status. To facilitate recruitment, incentives were given for students who returned consent forms, regardless of whether their parents or guardians granted or denied consent. After assent was granted from the students whose parents provided consent, the research team collected self-report data in group format in the schools. The measures included in this study were a part of a larger survey packet for a project that evaluated the associations among psychosocial variables, physical activity, and weight status. Research assistants read questions aloud to students to ensure that children's participation was not restricted by reading comprehension. Participants received gift cards and small trinkets (e.g., shirts and cups) for their participation in the study. The methods described above were approved by the KU Human Subjects Committee (HSCL# STUDY00000035) and the Lawrence Public School System (USD497).

Measures

Demographics. Demographic information including child age, date of birth, sex, race/ethnicity, and grade were collected via a self-report questionnaire.

Weight status. Research staff obtained height and weight for children without shoes to the nearest 0.1 centimeter and 0.1 kilogram, respectively. Height and weight were acquired after

[1] Children with BMI under the 5th percentile were excluded because their data may have attenuated the relationship between BMI and disordered eating. Two per cent of participants were excluded based on BMI.

the completion of measures in order to prevent any influence on the questions regarding eating attitudes and behaviors. Double measurements of height and weight were obtained and averaged, Body Mass Index (BMI) was calculated, and BMI was converted to BMI-for-age percentile based on age and sex as recommended by the Centers for Disease Control (Centers for Disease Control and Prevention [CDC], 2011). According to the CDC, children with BMI-for-age between the 5th and 85th percentile are considered healthy weight, between the 85th and 95th percentiles are considered overweight, and above the 95th percentile are considered obese (CDC, 2011). A z-score for BMI-for-age was calculated and used for analyses.

Health-related quality of life. The Pediatric Quality of Life Inventory (PedsQL™ 4.0; Varni, Seid, & Kurtin, 2001) is a 23-item measure of health-related quality of life that can be used in healthy community samples as well as in samples of children with medical conditions. The current study used the self-report version for children between the ages of 8 and 12. This instrument comprises a Total Scale Score and 4 subscales corresponding to physical, emotional, social, and academic functioning. Children were instructed to indicate how much of a problem each item had been for them in the past one month on a scale from 0 ("*Never*") to 4 ("*Almost Always*"). Reliability and validity have been established among youth of all ages and among both healthy children and children with medical conditions. The internal consistency for the Total Score has been estimated at $\alpha = 0.88$; therefore, the Total Score for the PedsQL has been determined to be an appropriate summary score, and it was used for analyses in the current study (Varni, Seid, & Kurtin, 2001). The internal consistency for the current sample was $\alpha = 0.89$.

Disordered eating attitudes and behaviors. The Children's Eating Attitudes Test (ChEAT; Maloney, McGuire, & Daniels, 1988) was used to assess children's self-report of disordered eating attitudes and behaviors. The traditional format of this measure includes 26

items within four domains: dieting, food preoccupation, oral control, and restricting and purging. Example questions include "*I eat diet foods*" and "*I stay away from foods with sugar in them*." Traditional scoring of the ChEAT includes a 4-point Likert scale ranging from "*Never*" to "*Always*." Ratings of "*Never*," "*Rarely*," and "*Sometimes*" are assigned scores of 0, while "*Often*" is assigned a score of 1, "*Very Often*" is assigned a score of 2, and "*Always*" is assigned a score of 3. With this 4-point scoring, total scores could range from 0-78 with higher scores indicating higher disordered eating attitudes and behaviors. A cut-off score of 20 or above suggests clinically significant disordered eating attitudes and behaviors (Maloney et al., 1988).

While the traditional 4-point Likert scale has been widely used, this scoring system reduces variability in items and total scores, which can be problematic when employing a non-clinical sample of children (Anton et al., 2006). To address this reduced variability, Anton and colleagues (2006) validated a new scoring method using 20-items and a full 6-point Likert scale in a community sample of children in 2^{nd}-6^{th} grades. Instead of the 4-factor structure of dieting, food preoccupation, oral control, and restricting/purging mentioned previously, Anton and colleagues (2006) found a 6-factor structure including overconcern with body size, dieting, food preoccupation, social pressure to gain weight, vomiting, and calorie awareness and control. With the revised scoring system, variability was increased, median scores were distributed more evenly, and skewness was decreased (Anton et al., 2006); therefore, the revised scoring system was used for this study with the nonclinical, community sample. The Total Score was used for analyses in the current study, after excluding the 3 questions from the social pressure to gain weight subscale, as this subscale is likely to be inversely related to the other subscales in this sample. The internal consistency for the current sample was α=0.83.

Negative affect. The child self-report version of the Positive and Negative Affect Scale (PANAS-C; Laurent et al., 1999) was used to measure negative affect. The PANAS-C is a 27-item measure with 15 questions that assess negative affect. Children were instructed to report how often they felt the negative emotions (e.g., nervous, afraid, gloomy) during the past few weeks on a scale from 1 ("*Not at all*") to 5 ("*Extremely*"). Reliability and validity have been established, with internal consistency estimates between α=0.92 and 0.94 for the negative affect scale and convergent validity with other depression and anxiety measures (Laurent et al., 1999). The internal consistency of the current sample was α=0.98.

Data Analysis Plan

Descriptive statistics (means, SDs) and Pearson correlations were calculated for demographic variables, BMI, negative affect, disordered eating attitudes and behaviors, and HRQOL. To test the stated hypotheses, a moderated mediation model was analyzed to determine the indirect effect of BMI on HRQOL through disordered eating attitudes, with negative affect serving as a moderator of the relationship between BMI and disordered eating attitudes and behaviors (see Figure 2). Moderated mediation was tested using IBM SPSS Statistics Version 22 "Process" macro with bootstrapping (Preacher, Rucker, & Hayes, 2007). Bootstrapping is a statistical method that involves drawing repeated samples and obtaining indirect effects from each resampled data set. This statistical method does not impose the assumption of normality and maintains adequate control over Type 1 error rates. These advantages make the bootstrapping approach more favorable compared to the Sobel test (Preacher, Rucker, & Hayes, 2007). The conditional indirect effects of BMI on HRQOL through disordered eating attitudes and behaviors at different values of negative affect were analyzed while controlling for child age

and gender. Parameter estimates and confidence intervals were generated based on 10,000 bootstrapped samples.

Given the hypothesized data analysis plan, an *a priori* power analysis was conducted using G*Power 3.1.9.2 in order to determine how likely it would be to find a significant result assuming an effect exists in the population. The power analysis revealed that with 6 predictors, an alpha coefficient of 0.05, and a small-medium effect size of 0.10 (see Gowey et al., 2014), there would be 80% power to detect effects with a sample size of 143. Furthermore, the estimate of the sample size calculated using G*Power was compared to the empirical estimates required to detect mediation effects provided by Fritz and MacKinnon (2007). Based on previous studies that provided regression coefficients between the relevant variables, an α path of 0.25 (see Rodgers et al., 2014) and a β path of -0.24 (see Gowey et al., 2014) would require a sample size of 148 using bias-corrected bootstrap procedures (Fritz and MacKinnon, 2007). Therefore, the sample size of 165 provided sufficient power to test the study hypotheses.

Results

The mean age of participants was 9.41 years (*SD* = 1.01), and half (50%) of the children participating in the study were female. The majority of children identified themselves as Caucasian (68.6%), with a smaller number identifying as African American (6.4%), American Indian (4.5%), Hispanic (2.6%), Asian (2.6%), and other (15.4%). The mean BMI *z*-score for children was 0.24 (*SD* = 1.01), with the majority of the participants considered healthy weight (74.39%); 15.24% of participants were overweight, and 10.37% were obese.

Preliminary Analyses

Means and standard deviations among all study variables are presented in Table 1. The average item score for negative affect indicated that most children in the sample reported low

levels of negative affect (Laurent et al., 1999), and the average item score for disordered eating attitudes and behaviors indicated that most children reported that they rarely engaged in such attitudes and behaviors (Anton et al., 2006). When examining disordered eating using the traditional 4-point scoring (Maloney et al., 1988), 5.48% of the sample received a score of 20 or above, which indicates clinically significant disordered eating attitudes and behaviors. In terms of HRQOL, the children in the current sample reported similar levels as the 8-12 year old participants in a school validation of the PedsQL (M = 79.59, SD = 13.89; Varni, Burwinkle, & Seid, 2006).

Pearson correlations were conducted to examine associations among study variables (see Table 1). As expected, disordered eating attitudes and behaviors were significantly and positively associated with BMI *z*-score and negative affect. In addition, HRQOL was significantly and negatively associated with BMI *z*-score, negative affect, and disordered eating attitudes and behaviors. Child age was positively correlated with HRQOL, such that older children were more likely to report higher HRQOL. Thus, child age was controlled for in subsequent mediation analyses. Also, there were significant differences in negative affect and HRQOL across child sex. Girls, on average, reported more negative affect (M = 2.06, SD = 0.83) than boys (M = 1.56, SD = 0.50), $t(157) = 4.59$, $p = <.001$. On the other hand, boys, on average, reported higher HRQOL (M = 79.48, SD = 12.11) than girls (M = 74.37, SD = 16.29), $t(162) = -2.28$, $p = <.05$.

Table 1

Pearson correlations among primary variables

Variable	1	2	3	4	5	6
1. BMI *z*-score	—					
2. Negative Affect	.02	—				
3. Disordered Eating Attitudes/Behaviors	.29**	.18*	—			
4. Health-Related Quality of Life	-.15*	-.64**	-.26**	—		
5. Child Age	.03	-.04	.09	.20*	—	
6. Child Sex	.07	-.34**	.02	.18*	-.01	—
M	0.24	1.81	2.11	76.92	9.41	—
SD	1.01	0.73	0.59	14.54	1.01	—

Note. *p <.05, **p < .01; Child age and sex were controlled for in mediation analyses

Mediation Analyses

Figure 3 shows the unstandardized regression coefficients for the mediation model. The indirect effect of BMI *z*-score on HRQOL through disordered eating attitudes and behavior was significant (BCa 95% CI [-2.18, -0.24]); more specifically, higher BMI *z*-score was positively related to disordered eating attitudes and behaviors, which in turn was negatively related to HRQOL. As seen in Figure 1, the direct path from BMI *z*-score to HRQOL dropped from a significant unstandardized beta of -2.49 ($p<.05$; as noted by path c) to a non-significant beta of -0.48 ($p=.18$) when the indirect effect through disordered eating attitudes and behaviors was added to the model (as noted by path c'). The mediation model accounted for 15.49% of the variance in HRQOL.

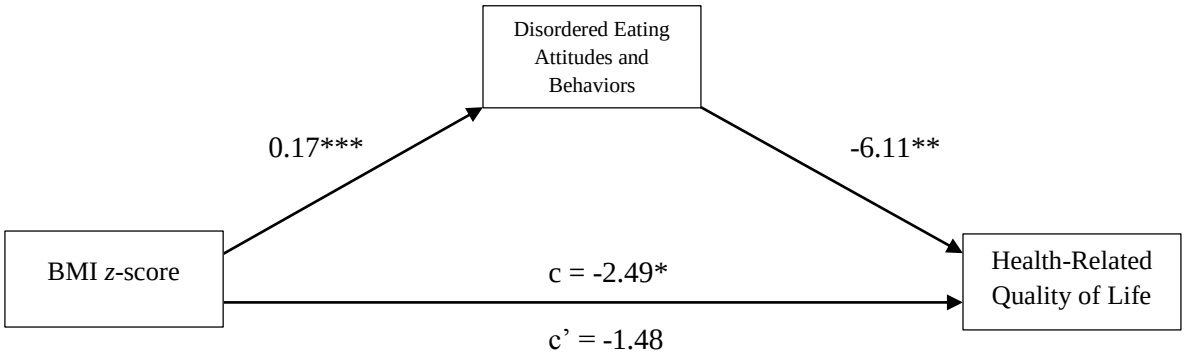

Figure 3. Mediation model: Influence of Body Mass Index on health-related quality of life through disordered eating attitudes and behaviors while controlling for child age and sex. Unstandardized regression coefficients from a bootstrap procedure are provided along the paths.*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Moderated Mediation Analyses

Figure 4 shows the unstandardized regression coefficients for the moderated mediation model. As mentioned previously, the indirect effect of BMI *z*-score on HRQOL through disordered eating attitudes and behavior was significant; more specifically, higher BMI *z*-score was positively related to disordered eating attitudes and behaviors, which in turn was negatively related to HRQOL. This relationship held for both high and low levels of negative affect as demonstrated by the non-significant interaction between BMI *z*-score and negative affect (see Table 2). Therefore, the moderated mediation model was not significant. The moderated mediation model accounted for 15.64% of the variance in HRQOL, which indicated that the addition of the moderator did not explain any more variance in HRQOL than the mediation model.

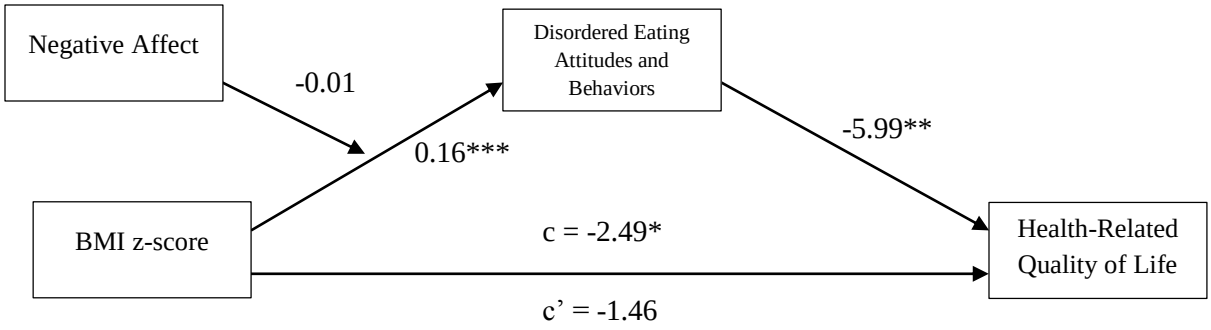

Figure 4. Moderated mediation model: Influence of Body Mass Index on health-related quality of life through disordered eating attitudes and behaviors with negative affect as a moderator, while controlling for child age and sex. Unstandardized regression coefficients from a bootstrap procedure are provided along the paths.*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 2

Regression analysis exploring the mediator and moderator of the relationship between BMI z-score and HRQOL

Variable	B	se	*p*	*F*	R^2
Outcome: Disordered Eating Attitudes and Behaviors[a]				4.16	.12
BMI z-score	0.16	0.04	.00***		
Negative Affect	0.16	0.07	.02*		
BMI x Negative Affect	-0.01	0.06	.88		
Outcome: Health-Related Quality of Life[a]				7.09	.16
Disordered Eating Attitudes and Behaviors	-5.99	1.92	.00**		
BMI z-Score	-1.46	1.11	.19		

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$
[a] Controlling for child age and sex

Discussion

The current study was designed to examine the indirect effect of BMI on HRQOL through disordered eating attitudes and behaviors in a community sample of preadolescent children, as well as the degree to which negative affect moderated the association between BMI and disordered eating attitudes and behaviors. Previous research has examined relationships among these variables in treatment-seeking samples or with adolescent samples (e.g., Doyle et al., 2007; Gowey et al., 2014; Herpertz-Dahlmann et al., 2008). The current study is unique and advances the field because it examined the relationships among BMI, negative affect, disordered eating attitudes and behaviors, and HROQL in a community sample of preadolescent youth. In addition, the existing literature has explored these variables separately, but the current study examined these variables together in one model in order to understand the mechanisms of action.

As hypothesized, the indirect effect of BMI on HRQOL through disordered eating attitudes and behavior was significant; more specifically, higher BMI predicted higher levels of disordered eating attitudes and behaviors, which in turn predicted lower levels of HRQOL. There was a significant direct relationship between BMI and HRQOL prior to the addition of the mediator, which was reduced to non-significance with the addition of the mediator. These findings are consistent with the results from Gowey et al. (2014), who found that both BMI and disordered eating attitudes and behaviors were predictors of HRQOL in rural children with obesity. Although Gowey and colleagues (2014) identified these same two direct paths (BMI and disordered eating with HRQOL), they did not examine the relationship between BMI and disordered eating attitudes and behaviors.

As noted by Tsiros et al. (2009) and Buttitta et al., (2014), understanding the mechanism of action that underlie the relationship between BMI and HRQOL is important in order to inform

early treatment and intervention efforts to prevent poor quality of life in youth with higher weight status. Findings suggest that weight reduction alone may not be wholly responsible for changes in HRQOL, but that clinicians and health care providers should also assess and address disordered eating attitudes and behaviors in youth with higher weight statuses in order to prevent poor HRQOL. More specifically, professionals should carefully assess eating attitudes and behaviors of children prior to adolescence and educate families about the importance of adopting healthy eating habits that promote gradual weight loss.

This idea of incorporating disordered eating attitudes and behaviors into prevention and intervention programs has been suggested previously by Neumark-Sztainer, Wall, and Perry (2003). Specifically, the authors suggested interventions that aim to decrease weight concerns and improve body image in school or community settings (Neumark-Sztainer et al., 2003). Follansbee-Junger, Janicke, and Sallinen (2010) also suggested that weight management programs could benefit from incorporating intervention components that target disordered eating attitudes and behaviors due to obese youth being at increased risk. Although there are a few examples of weight management interventions that assess and incorporate disordered eating attitudes and behaviors as targets of change (e.g., Janicke et al., 2011), Carter and Bulik (2008) found that most pediatric weight management interventions do not sufficiently assess or target disordered eating attitudes and behaviors. Assessment measures like the ChEAT (Maloney et al., 1988) and the PedsQL (Varni et al., 2001) are useful tools for the assessment of these measures in community and clinical samples. More research should be done to examine the effectiveness of incorporating prevention and intervention efforts for disordered eating attitudes and behaviors within weight management programs.

The results did not support the second hypothesis of negative affect as a moderator of the relationship between BMI and disordered eating attitudes and behavior, as evidenced by a non-significant interaction between BMI and negative affect. As expected, negative affect was associated with disordered eating, but it was not associated with BMI; the non-significant correlation found in the current study was surprising in light of the research by Rodgers, Paxton, and McLean (2014) who found that BMI and negative affect were correlated. The non-significant interaction found in the current study was also surprising in light of the study by Vander Wal (2012) who found that there was an interaction between weight status and negative affect predicting unhealthy weight control behaviors. It is worth noting that the samples in the studies by Rodgers et al. (2014) and Vander Wal (2012) were both adolescent female samples.

Perhaps the correlation between BMI and negative affect and the interaction predicting disordered eating attitudes and behaviors only holds for adolescents. The idea that negative affect is a less salient construct for preadolescents was raised by Saling, Ricciardelli, and McCabe (2005), who posited that preadolescents may not associate disordered eating attitudes and behaviors with the expectation that these attitudes and behaviors will result in relief from negative affect. However, Sinton and Birch (2005) found that preadolescent girls with higher BMI and higher depression were more likely to exhibit disordered eating attitudes and behaviors. Another hypothesis could be that this relationship only holds for preadolescent and adolescent girls, but not for boys. This hypothesis was supported by Ricciardelli, McCabe, Lillis, and Thomas (2006), who found that negative affect was a weak predictor of disordered eating attitudes and behaviors in preadolescent boys; the authors explained that negative affect might not be as important of a factor to consider for boys. More research is needed to examine the role

of negative affect in the relationship between BMI and disordered eating in preadolescent boys and girls.

The interpretation of these findings must be considered in the context of several limitations of the study. The cross-sectional nature of this data precludes the conclusions about causality and directionality between the study variables. For example, the literature shows that disordered eating attitudes and behaviors in childhood can lead to later obesity (Neumark-Sztainer et al., 2006); therefore, there may be a bidirectional relationship between weight status and disordered eating. To determine true mediation and directionality, future research should examine these variables in a longitudinal study. Additionally, there may be other important variables that are important to consider within the larger conceptual framework of these variables which were not included in this model. For example, Evans, Tovée, Boothroyd, and Drewett (2013) asserted that thin-ideal internalization and body dissatisfaction were underlying processes of disordered eating, so these variables may explain the relationship between BMI and disordered eating attitudes and behaviors. Given that disordered eating only accounted for 15% of the variance in the model, future research should examine other factors that might influence HRQOL.

Despite these limitations, the current study has several strengths. First, the current study examined the relationships among BMI, negative affect, disordered eating attitudes and behaviors, and HROQL in a community sample of preadolescent youth. The community sample allowed for the examination of the variables across a range of BMI values and severities of disordered eating and HRQOL, which allowed for more generalizability to non-clinical populations of children. Also, many studies examining predictors of disordered eating behaviors have featured samples that are composed mostly of adolescents and females (e.g., Rodgers et al.,

2014; Vander Wal, 2012), whereas our sample examined a population of preadolescent boys and girls. As noted above, disordered eating attitudes and behaviors are becoming more common in young children and these attitudes and behaviors are risk factors for later engagement in disordered eating; therefore, better knowledge of these constructs in preadolescents is necessary in order to intervene early prior to the progression to full-syndrome eating disorders. Lastly, the existing literature includes explorations of these variables separately, but the current study examined these variables together in one model in order to understand the mechanisms of action.

Overall, these findings highlight the importance of examining disordered eating attitudes and behaviors in preadolescents. Findings showed that preadolescents with higher weight status are more likely to engage in disordered eating attitudes and behavior, and that disordered eating attitudes and behaviors are related to lower HRQOL. Findings also indicated that the indirect relationship between BMI and HRQOL through disordered eating attitudes and behaviors is not conditional on the level of negative affect. Intervening on disordered eating attitudes and behaviors in preadolescents with higher weight status is critical to prevent the risk trajectory for future clinical eating disorders and poor HRQOL.

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